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Santiago, Chile, 19 to 23 November 1984

OPTIONS OF VERTICAL INTEGRATION OF MINING IN LATIN AMERICA *

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OPTIONS OF VERTICAL INTEGRATION OF MINING IN LATIN AMERICA

G.P. SALAS, ENGINEER+

INTRODUCTION

In the context of the social and economic development of countries, the mineral resources have a close relationship with the growth of productivity of their sectors and the greatest availability of the strategic factors of production. Because of their greater possibilities of profit and financial surplus, they are one of the sectors whose expansion can help generate and sustain this development.

The countries of the region cannot fail to make full use of the advantages derived from these resources. To achieve this end, they not only have to solve problems relative to international financing and commerce, but also those that come from the very nature of the sector.

The analysis of the different subjects to develop in this meeting will have to be determined in order to achieve a major united action from the Latin American countries that will permit the reaching of the following priority objectives for developing countries.

1.- The vertical integration of mining for the production process, with the object of developing in accelerated form the industrialization of the products derived from the sector.

2.- The comprehension of financial resources to extend the work of mineral exploration, production and benefit to

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the level of melting where possible.

3.- Improved negotiation capacity to obtain greater participation in the commercialization of minerals, improving the internationalization of their own regional markets.

The Vertical Integration of Mining is always recommendable because the product is sold with greater overall value. Jobs are generated; a higher percentage of countable results are produced in making use of the raw or concentrated product. But, this requires satisfying demands of productivity, reserves, metallurgy, etc., as will be seen later.

The Vertical Integration of Mining Companies not only in Latin America, but all over the world, is supported by the fact that the production of one or several minerals has such a volume that it guarantees the income-yield capacity of the investment for the melting of concentrates with or without refining, and offering to the captive internal market and the international market, metal (billet) or consumer goods, in their case, of quality and competitive price.

In Latin America the scarcity of published information referent to annual mineral production as compared with metallurgy is general. This shortage of basic information makes the analysis of the problem of the low level of metallurgic product in the countries of the region difficult.

With respect to Potential Reserve of Minerals in Latin America, the author (see Bibliography) has done a study on this subject in several countries of Latin America with positive results, but more geotectonical and metallogenetic details are needed for a more realistic evaluation of the mining potential of this region.

In the work presented in Reston, Virginia, U.S.A., (Salas, 1979), the author tried to calculate producible reserves (not potential), for a number of minerals in those countries from which it was possible to obtain data. The results are shown in the tables of **Anexo I.**

A quick study of those figures shows that Brazil, Mexico, Chile and Peru stand out for their volume and variety of produced metals. But Mexico as well as Brazil has a greater

number of options for diversification of Vertical Integration for its high variability in mineral production in addition to its great internal consumption.

The study relative to production and reserves shows that in some cases as in that of Brazil the major part of its production of tin, bismuth and antimony has been integrated for exportation, and on a lesser scale, for internal consumption.

It is in this way that the options for a Vertical Integration are restricted to those countries that satisfy a certain number of requisites.

REQUISITES FOR VERTICAL INTEGRATION MINING

1.- Sufficient mineral reserves that are meant to benefit to the level of billet or refining that can be produced economically within a sufficiently extended time lapse in order to assure the income-yield capacity of the investment.

2.- It is not essential, but is recommendable to have a captive internal market, sufficiently ample, that will sustain the operation economically when the international market slacks off or comes to a standstill.

3.- The preceding therefore is related to the population of the country in question. As it will be seen later, in this respect, Brazil with 141 million inhabitants and Mexico with more than 70 million and with ample territorial surface, great mining diversification and good mineral reserves fill the basic requisites to have the largest number of vertically integrated mining companies.

4.- Other countries like Chile and Peru, for example, have large integrated companies, but whether it be because of imposed restrictions, their topography, their scarce demographic development or economic reasons, the number of integrated operations is reduced.

5.- Financing. Assuming that a mining company fulfills the requirements for contemplating a vertical integration,

the problem of financing soon follows. The scaled economy demands large volumes of treatment and production. This requires a great investment. To guarantee its amortization, a good mine with ample proven resources is needed. At this time it is difficult to get adequate financing.

Therefore, thare are two options for Vertical Integration: One is associating with someone who will finance, run risks and preferably have "know how"; and the other is local financing and not in foreign money because of the uncertainty that exists with respect to interest rates, etc. This last option can be achieved by making public the offer of actions or chirographary documents in local money, etc.

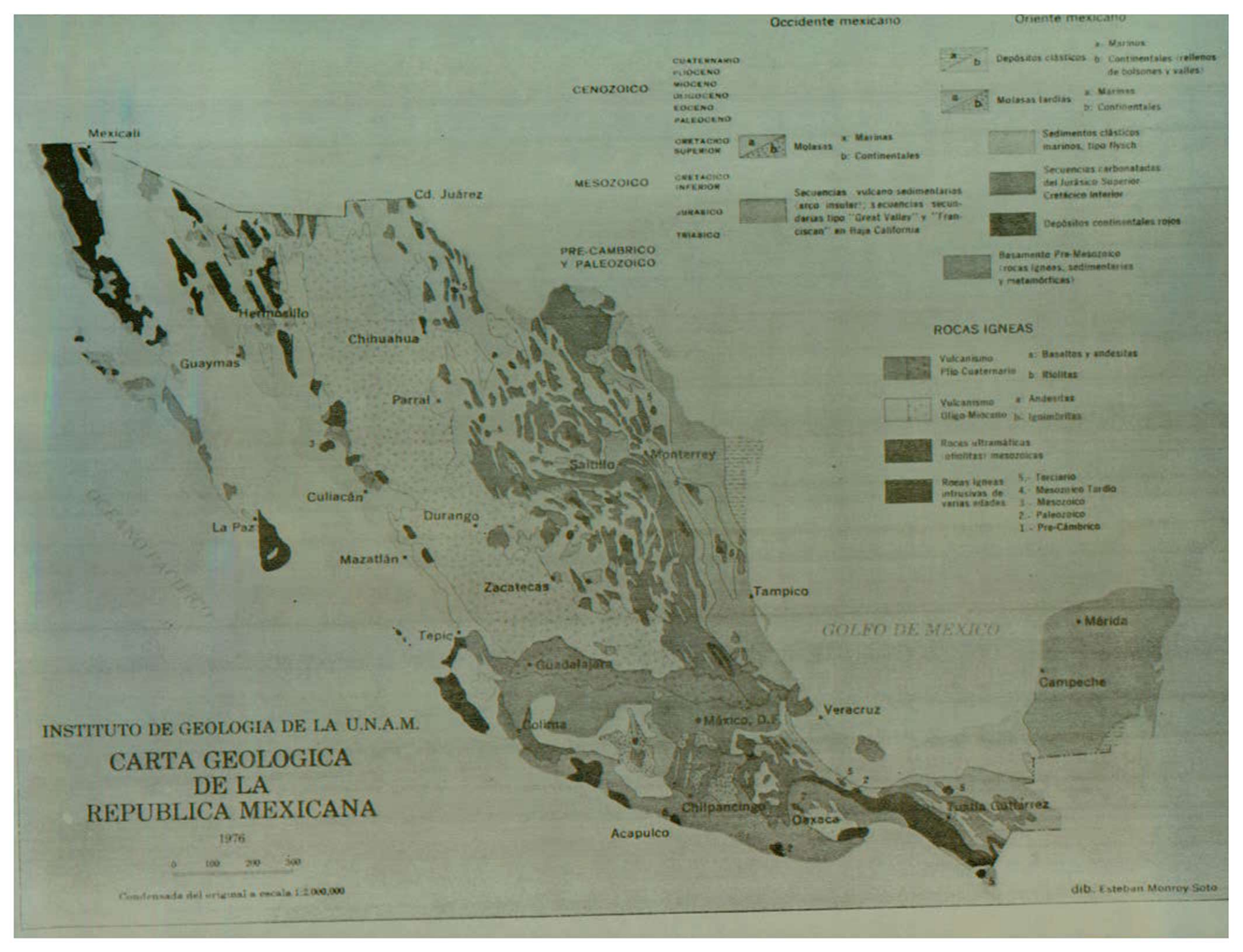
6.- Finally, even when it is known that all of the countries of the area have mining and fiscal laws, it is worth mentioning that these motivate the mining investor to convert metallic concentrates into metal, or non-metallic minerals into consumer goods; in this way, a vertical integration of a greater number of mining companies is achieved.

MULTILATERAL INTEGRATION, ANOTHER OPTION

Until now, the Vertical Integration of a company has been considered even when it could have many sources of its own raw material for its metallurgic industry.

Another option can now be considered to achieve the same objective, only multiple. In many Metallogenetic Provinces there are several mineral deposits near each other and of similar minerology, i.e., they produce similar products; for example, polymetallic deposits of gold, silver, lead, zinc and copper. These deposits are very common in the extrusive igneus in rhyolites and andesites or in a calcareous environment.

The mines that are developed in these districts usually belong to several small and medium mines. If a group is successful in joining efforts and resources, besides being able to finance and construct a Concentrative Plant, for example, of flotation, they can also join forces to melt their concen-


Occidente mexicano
Oriente mexicano
CENOZOICO
CUATERNARIO
PLIOCENO
MIOCENO
OLIGOCENO
EOCENO
PALEOCENO
MESOZOICO
CRETACICO SUPERIOR
CRETACICO INFERIOR
JURASICO
TRIASICO
PRE-CAMBRICO Y PALEOZOICO
Depósitos clásticos
a: Marinos
b: Continentales (rellenos de bolsones y valles)
Molasas tardías
a: Marinas
b: Continentales
Molasas
a: Marinas
b: Continentales
Sedimentos clásticos marinos, tipo flysch
Secuencias carbonatadas del Jurásico Superior Cretácico Inferior
Depósitos continentales rojos
Secuencias vulcano sedimentarias (arco insular); secuencias secundarias tipo "Great Valley" y "Franciscan" en Baja California
Basamento Pre-Mesozoico (rocas ígneas, sedimentarias y metamórficas)
ROCAS IGNEAS
Vulcanismo Plio Cuaternario
a: Basaltos y andesitas
b: Riolitas
Vulcanismo Oligo-Mioceno
a: Andesitas
b: Ignimbritas
Rocas ultramáficas ofiolitas: mesozoicas
Rocas ígneas intrusivas de varias edades
5.- Terciario
4.- Mesozoico Tardío
3.- Mesozoico
2.- Paleozoico
1.- Pre-Cámbrico
Mexicali
Cd. Juárez
Hermosillo
Chihuahua
Guaymas
Parral
Saltillo
Monterrey
Culiacán
La Paz
Durango
Mazatlán
Zacatecas
Tampico
Tepic
Guadalajara
Colima
México, D.F.
Veracruz
Mérida
Campeche
Chilpancingo
Oaxaca
Tuxtla Gutiérrez
Acapulco
GOLFO DE MEXICO
OCEANO PACIFICO
INSTITUTO DE GEOLOGIA DE LA U.N.A.M.
CARTA GEOLOGICA DE LA REPUBLICA MEXICANA
1976
0 100 200 300
Condensada del original a escala 1:2'000,000
dib. Esteban Monroy Soto

concentrated mineral. This could turn into a cooperative or association joining its assets and liabilities and looking for financing as in point 5 above.

If the foregoing is put into effect, freight and tolls from the large foundries can be saved. The study of viability would consider a Concentration Plant capacity with a base and proven mineral resources in all of the mines, and in the volume of concentration as well as in that of melting, it would be considered the lowest scaled economy. The object would be to achieve the financing and functioning of the plants in the shortest possible time so that the product contributes to the financing in both cases. This is problematic, but not impossible.

This system is especially recommendable for the small mines of Mexico and Peru. Furthermore, the idea is applicable for melting mineral from small mines of the area, even if they are not associates.

THE CASE OF MEXICO

To illustrate the possible options for achieving the Vertical Integration of Latin American mining, the case of Mexican mining is cited because it fulfills the basic requisites that Vertical Integration permits.

Geography.- Mexico has an approximate surface of 2,000,000km.^{2}. It extends between the parallels 32° 30' and 14° 30' North Latitude and between the meridians 117° 15' and 86° 45' West Longitude. Its coasts on the Gulf of Mexico, the Caribbean and the Pacific Ocean, have a continental and peninsular longitude of approximately 10,000 Kms. Its Continental Shelf has a surface up to the isobath of 100m. of 500,000 Km.^{2}, with greater amplitude in the Gulf of Mexico and the Caribbean to the north from the states of Campeche and the Yucatan Peninsula. The Altiplano between the east and west Sierra Madres have an average elevation (s.n.m.) of 2,200m. The country has cold, temperate and tropical climates.

Geology.- In summary, approximately 1,500,000Km.^{2} are made up of extrusive volcanic rocks from Cenozoico; metamorphic from Precambrico; and intrusive from Mesozoico and Ceno-

zoico. It is in this environment that the major part of the metallic and non-metallic mines can be found. In the eastern part of the Sierra Madre Oriental, formed by Clastic and chalk from Mesozoico and Planicie Costera (coast plain) formed by the Cuenca Sedimentaria of Cenozoico, make up the Petroliferous Provinces with the greater part of the reserves of hydrocarbons, especially in the southeast of the country. (See Geologic and Metallogenetic charts, pp. 4-A and 4-B).

Legislation.- Mexico, like Peru, has a mining history from the Precolumbian Epoch, and owes its development in part to the mining industry of the Colonial Epoch. The Royal Ordinances of Mining, the first mining legislation in America, date from this epoch.

Mexican mining is controlled basically by the Regulatory Law of Article 27 of the Constitution and its bylaws. Through the Secretary of Energy, Mines and Semi-state Industry (SEMIP), the state exercises the functions derived from Constitutional mandate the dominion of the nation has over the mineral resources. The Secretary of Energy, Mines and Semi-state Industry regulates the development of mining with the following organisms: The Council of Mineral Resources, The Commission of Mining Development and the Trusteeship of Non-metallic Minerals.

The Council of Mineral Resources explores, evaluates and delivers proven reserves to the Commission of Mining Development for their promotion and eventual development. It also assists the Federal Government in the matter of National Mine Reserves and assists and finances evaluative exploration to the small and medium mine.

The Commission of Mining Development finances and assists the small and medium mine for development. In addition, it provides assistance to their minerals, charging a toll on their treatment plants distributed throughout the states and mining districts.

The Trusteeship of Non-metallic Minerals promotes the full use of non-metallic minerals and advises and collaborates with the rural sector for the exploitation of construction

rocks and others.

The National Mine is integrated: Majority State Participation 39% of the Internal Mining Product (1983); The Large Private Mine 49% of the IMP(Internal Mine Product); The Small and Medium Mine contributed with 12% of the IMP in 1983.

The Mining Chamber of Mexico is the institutional representation of the business entities and a channel of communication and consultation with the Federal Government. It gathers companies from the public and private sector.

The National Syndicate of Mining, Metallurgic and Other Workers of the Mexican Republic retains the majority of collective contracts of mining work in Mexico.

The Mine is complemented by the Association and College of Mining Engineers, Metallurgists and Geologists of Mexico; the Mexican Geological Society; the Federation of Small and Medium Mines, A.C. and the Assembly of Medium Mineral Producers of Mexico, A.C.

In 1961, the new mining law and its bylaw established the nationalization of mining in the country. In summary, those companies that have a 51% minimum of national capital and a maximum of 49% of foreign capital will be benefitted by attractive tax cuts. From that year to the present almost all mining companies are Mexican. This measure was very positive for foreign and national capital and put the direction of all the large companies in the hands of Mexican technicians. This also turned out to be a great impulse to mining-metallurgic development in the mining of the country.

The present mining law specifies that the Board of Mines, which depends directly on the Secretary of Energy, Mines, and Semi-state Industry (SEMSI), can, with the Secretary's approval, grant exploration and exploitation concessions to individuals and private and semi-state companies for the usufruct of the mineral values they discover.

Without going into detail with respect to the concessions and the geographic limitations, obligations and privileges, it is beneficial to mention that they can obtain concessions on land of public domain and on National Mine Reserve land. In the first case, the capital can form 51% national, private or mixed and 49% foreign, no matter what the nationality. In the second case, the capital is composed of a minimum of 66% national, private or mixed and 34% maximum of foreign capital.

SOME ARTICLES PERTAINING TO THE REGULATIONARY LAW OF ARTICLE 27 OF THE CONSTITUTION ON THE SUBJECT OF MINING

Article 6.- The exploration, exploitation, benefit and full use of the mineral substances can be brought about:

a) By the state, through the Council of Mineral Resources and the Commission of Mineral Development in the sphere of their respective competencies and by the companies of majority state participation.

b) By companies of minority state participation or

c) By private parties whether they be physical or moral persons.

The Federal Executive through the Secretary of National Patrimony, will grant the corresponding assignation or concession for the exploration, exploitation, and benefit of the substances or minerals to which this law refers, in accordance with the requisites and procedures that are designated with posterity.

Article 11.- Physical persons of Mexican nationality, selected individuals and community farmers with the preferent conditions to which the Federal Law of Agrarian Reform refers, the Society Cooperatives of Mining Production that are constituted according to the respective law and authorized and

registered by the Secretary of Industry and Commerce and the Mexican Mercantile Societies in accordance with the specifications of this law, can obtain the concessions to which this law refers.

Article 15.- The concessions to which this law refers and the rights that are derived from them may not be granted or transmitted in full or in part to foreigners whether they be physical persons, societies, sovereigns, states or governments, nor to Mexican societies in which foreigners represent in capital a larger percentage than that indicated for each case in Articles 12 and 13 of this law.

Third Chapter

On the Mining Concessions

Article 34.- The solicited assignations and the mining concessions of exploitation will only protect a mining share with a maximum surface of 500 hectares.

Fourth Chapter

On the Concessions for Benefit Plants

Article 56.- For purposes of this law, by the Benefit Plant is meant the industrial establishment in which there are mineral substances of national or foreign origin, mechanical preparation or mining-metallurgic operations of any kind, including melting and refining operations.

Article 57.- A concession expedited by the Secretary of National Patrimony will be required for the installation and functioning of Benefit Plants, with the exception of those of private service with a capacity of less than one hundred tons of mineral in twenty-four hours, that they install the mining concession titles and the others that the regulation does not include.

Article 59.- The concession of the Benefit Plants will have a duration of twenty-five years, which will be counted beginning on the date of expedition of the respective title. Within three years before its termination, the concessionaire will have the right to negotiate and obtain a new concession for the Benefit Plant for an indefinite period, if he proves

that he has satisfied the obligations of this law and the corresponding regulations and title imposed on him. As soon as this last part has been carried out he may continue operating the respective plant.

Seventh Chapter

On the National Mine Reserves

Article 72.- The National Mine Reserves will be composed of:

I.- substances or zones that can not be exploited and that will be destined for the satisfaction of the future needs of the country.

II.- substances that can only be exploited by the state, by means of the Commission of Mining Development and Companies of Majority State Participation through Assignations; and

III.- substances that can be exploited by the Commission of Mining Development and the Companies of Majority State Participation through assignations, by Companies of Minority State Participation or by private parties through the granting of special concessions.

SOME FISCAL OBLIGATIONS

Beginning December 31, 1982, the fiscal obligations for the mining industry are guided by new resolutions. Some of them are presented here:

Chapter V

Article 56.- The mining concession titleholder should pay annually the rights for each hectare or fraction designated in the concession according to the following quotas:

I.- In mining concessions of exploration. . . . $30.00 Ps.

II.- In mining concessions of exploitation:
a) In the case of non-metallic minerals. . 90.00 "

b) In the case of metallic minerals . . . 180.00 "

If the concession of exploitation includes non-metallic and metallic minerals, the corresponding right will be paid to this last case.

Chapter XIII

Article 262.- Persons that extract the minerals indicated in Article 3 of the regulatory law of Article 27 of the Constitution on the subject of mining, whatever be its form of presentation, origin and the procedures employed to obtain them, are obliged to pay the mining right that is set forth in this chapter. The minerals designated in Article 4 are exempt from the payment of this right in the order cited (Hydrocarbons, Salts coming from natural waters and construction materials).

Article 263.- The mining right will be calculated by applying to the values that the minerals have before processing the general rate of 5%, or to special cases, the amounts indicated below:

I.- 7% for gold, silver and sulphur
II.- 2% for iron, carbon and manganese

In the case of the metallic minerals, the commercially usable metallic contents will be considered. Regarding non-metallic minerals, their dry weight will be considered.

Concerning small mines, instead of the mentioned rates, those of 4%, 6% and 1% will be applied respectively.

Article 264.- The mining right shall not be paid because of:

I. The metallic contents found in minerals presented for exportation in laws lower than the following:

a) gold 0.5 grams per ton
b) silver 25.0 grams per ton
c) copper 0.5% per ton
d) lead 1.5% per ton
e) zinc 5% per ton

II.- The minerals that are obtained from manufactured products by recycling procedures.

III.- Common salt or sodium chloride.

Article 265.- The value of the minerals will be that which the Secretary of Finance and Public Credit determines each month taking into account:

I. The average market quotations in New York from the 16th day of one month to the 15th day of the following, of the two months immediately preceding that for which the values are figured;

II. The average quotations of other markets, when the major part of the national production of a determined mineral is exported at these prices, and the mentioned quotations differ by more than 5% of the amounts indicated in the preceding fraction; and

III. The wholesale prices of the minerals in the country that are destined for the most part for national consumption.

The value applicable to the minerals will be that corresponding to the moment in which they are submitted, transferred or made use of, as the case may be.

Article 274.- For the effects of this chapter, the small mine will be considered the taxpayer that during the previous calendar year has made a gross income for sales of minerals of less than twenty million pesos and that does not form part of a group of diverse mining and metallurgid units that belong to the same person or group of persons or when one or another is titleholder of the majority of the social capital of mining companies. It will not be considered as a Mining Group when the gross incomes of the same obtained for the sale of minerals has not exceeded the amount indicated in this article.

Article 275.- The States and the Federal District will participate in the incomes of the mining right in the terms of the Fiscal Coordination Law. In effect, the income of the mentioned right will be added to the total Federal col-

lection for the ends determined by the General and Complementary Financing Participation Funds to which parts I and II of the cited law refer.

PRODUCTION AND RESERVES

Anexo II shows the PRODUCTION-EXPORTATION-IMPORTATION Mineral of Mexico in 1983.

Mexico holds first place in world mineral production in silver, fluorite and arsenic; second place in celestite and sodium sulfate; third place in antimony and bismuth; fourth place in graphite, mercury and diatomite and fifth place in the production of lead, zinc, sulphur and feldspar. On the other hand, to abridge for Vertical Integration, Mexico has a variety of 17 metallic and 26 non-metallic minerals, a total of 43 minerals of which 28 come from mining companies that melt, refine or transform them (See ANNEX III). This is one consideration to keep in mind for the mining industry in those countries of Latin America that contemplate a study previous to the Vertical Integration of their mining.

Anexo III shows THE CONSUMPTION OF THE PRINCIPAL MINING-METALLURGIC PRODUCTS in Mexico in 1983. All of these products come from Vertically Integrated mining companies. The sulfur, although it is not transformed directly by the producing company, is converted into sulfuric acid for the production of phosphoric acid by an associate semi-state company. Common salt, sodium chloride, which is produced in Baja California Sur by solar evaporation, makes edible salt for national commerce; the use of evaporation residuals to obtain potasium sulfate is under study.

As far as Barite and Bentonite are concerned, they are made for sale through industrial treatment and within the specifications of the petroleum industry to which it is remitted in sacks or in bulk. Beginning in 1985, the mining company that produces celestite mineral will be Vertically Integrated to produce strontium carbonate in the state of Coahuila, Mexico.

The non-metallic minerals will be outstanding for their industrialisation by the same mining companies. In 1983 (incom-

plete data), sand and gravel, barite, bentonite, chalk, china-clay, carbon, celestite, diatomite, dolomite, feldspar, fluorite, Phosphorite, marble, mica, perlite, salt, silica, French chalk, Fuller dirt and gypsum will be processed and used.

The metallic minerals like silver, gold, iron, lead, zinc, cadmium and molybdenum also produce from the same mining companies that produce them. However, there are other minerals not listed that are manufactured in the country by Transformation Industries which are not necessarily mines.

A POSSIBLE VERTICAL INTEGRATION OPTION

In Mexico in at least one case, a group of 5 small mines united their forces, activities and mining production and constructed their own Benefit Plant of development for the minerals of lead, silver and zinc with a capacity of 200t/d. It has been functioning successfully for several years. At the present time it plans to increase its capacity to 400t/d.

It can be supposed, although it would not be easy, that even with difficulties this group, or a similar one, could advance its association to integrate it vertically and have its own foundry.

OTHER EXAMPLES IN MEXICO

Small Foundries.- On the same note as the preceding example, there are two cases of small mine producers of mainly lead oxides in Mexico that have achieved economic success in melting their own production in small foundries with a capacity of 100t/d. One of them is located in the city of Múzquiz, Coahuila and the other in the city of Zimapán, Hidalgo. Both worked successfully for several years while their lead minerals contained oxides of high quality. Now they have closed to change the conditions of their mineral and because of the high cost of coke and other constituents. However, this example, and even these same cases, can be solved given adequate conditions, and the same could take place in other countries.

INVERTED VERTICAL INTEGRATION

On the other hand, in Mexico there have been interesting cases of companies that were initially Transformation Industries using input from outside the company. With time they became Vertically Integrated from top to bottom. They initiated the production of their input several years after being a Transformation Industry.

Such is the case of the Vitro Group (formerly Monterrey Glass Factory) of Monterrey, N.L. The largest manufacturer of glass in all its forms since about 1950, it initiated the substitution of silica sand imported by the self-supply from its mines in Jaltipan, Ver. and later from San José Iturbide, Gto. Afterwards it produced its own sodium carbonate taking the salt from a salt dome close to the town of Mina, N.L. Now it has several subsidiary mining companies to explore, exploit and benefit the inputs that it needs (See **Anexo IV**).

Another example of Inverted Vertical Integration is the case of the company Met-Mex Peñoles, S.A. of C.V. (See **Anexo IV**. This company initiated its operations with a small mine in 1880 and on exhausting itself subsisted for many years as a foundry of lead, silver and gold, etc. This was its main operation for several years. In 1905 on opening the Mine of Hojuela in the state of Durango and later that of Avalos in Coahuila and others, it began producing its own inputs, integrating them vertically from top to bottom and creating the largest operation in Mexico.

It is important to recognize that in both cases, vertical integration was a fundamental factor in the technical-economic success of both companies, considering the enormous differences in the value of raw mineral material, of other inputs, the increase in financing and labor costs, etc. that directly affect the financial results of the operation. It is certainly of great significance that these important companies have their own reserves of minerals that are vital in their development.

The same can be said of some of the ceramic industries that began their operations as Transformation Industries with inputs that were imported or acquired from small mines and later were incorporated into the mining industry for for better quality control of argils, china-clay, etc. in their ceramic production, or of refactory construction baffle, etc.

The author has offered these examples so that they can be studied for their application in similar cases in other Latin American countries.

VERTICALLY INTEGRATED MINING COMPANIES IN MEXICO

In conclusion, ANNEX IV presents a list of vertically integrated Mexican mining companies about whose characteristics of organization, financing, etc., information can be obtained directly from their Boards of Directors.

CONCLUSION+

The author feels that such an important topic deserves an exhaustive study by way of direct contact of the investigator with the different mining companies or industries, especially when the mining companies contemplate the possibility of improving their economic situation by integrating vertically in order to have a metallurgic product of greater overall value, or in the case of the industries, of improving their economy by having their own raw mineral material.

Finally, it is obvious that the Latin American market will be increased in volume and variety of mineral and metallurgic products as a reflection of an increased forseeable demographic and the elevation of its standard of life.

To achieve the preceding, it is highly recommendable to augment the ways of communication among Latin American countries and to attempt an integration of their markets of consumption increasing in this way the commercial interchange of the sources of work in the countries of the region.

Guillermo P. Salas, Engineer

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A N E X O I

P R O D U C C I O N M I N E R A Y R E S E R V A S

E N L A T I N O A M E R I C A

PRODUCCION MINERA EN LATINOAMERICA
MILES DE TONELADAS

ANEXO I

PRODUCTO Y PAIS	1981	1982	1983 p/	RESERVAS
ANTIMONIO				
Bolivia	15	14	11	370
México	2	2	3	220
ARSENICO 1/				
México	1	4	3	N.D.
Perú	3	2	2	N.D.
AZUFRE				
México	2 077	1 815	1 602	100 000
BARITA				
México	318	324	357	9 000
Perú	409	363	227	7 000
BAUXITA				
Brasil	5 300	4 186	3 900	2 300 000
Jamaica	11 664	8 380	7 400	2 000 000
BERILIO				
Argentina	1	1	1	N.D.

PRODUCTO Y PAIS	1981	1982	1983 P/	RESERVAS
Brasil	24	32	35	N.D.
BISMUTO 1/ (Toneladas)				
Bolivia	9	5	-	14 500
México	656	606	545	6 400
Perú	544	699	635	4 500
BLOEDITA				
Argentina	25	56	54	N.D.
Chile	5	1	2	N.D.
BORAX				
Argentina	33	27	27	N.D.
Chile	1	N.D.	N.D.	N.D.
Perú	3	3	3	N.D.
CADMIO 2/				
México	1	1	1	25
CALIZA				
Brasil	4 989	4 989	5 170	N.D.
Chile	599	544	635	N.D.
México	39 046	40 880	35 276	N.D.

PRODUCTO Y PAIS	1981	1982	1983 p/	RENDIMIENTO
CULANTRO				
Brasil	13	12	11	3 000
COBRE				
Chile	1 080	1 241	1 250	97 000
Perú	328	369	330	32 000
DIATOMITA				
Brasil	17	16	18	2 300
México	57	56	44	N.D.
ESPATO				
Bolivia	30	27	25	930
Brasil	9	10	11	400
ESPODUMENO 3/ (Toneladas)				
Argentina	91	181	181	N.D.
México	13 156	13 607	13 607	N.D.
FELDESPATO				
Brasil	127	95	100	N.D.
México	131	116	118	N.D.

PRODUCTO Y PAIS	1981	1982	1983 e/	RESERVAS
FLUORITA				
México	925	631	507	21 700
CAPTIO				
México	42	36	44	N.D.
HIERRO				
Brasil	99 979	110 038	99 573	12 000 000
Venezuela	15 566	11 684	10 100	2 032 000
INDIO (Toneladas)				
Perú	5	5	5	60
LITIO (Toneladas)				
Argentina	2	2	2	N.D.
Brasil	60	59	64	N.D.
Chile	N.D.	N.D.	N.D.	1 180
MAGNESITA				
Brasil	101	80	91	136 080

PRODUCTO Y PAIS	1981	1982	1983 p/	RESERVAS
MANGANESO				
Brasil	1 696	1 300	1 270	103 290
MOLIBDENO				
Chile	15	20	15	2 450
Perú	2	3	3	230
NIQUEL				
Cuba	40	36	36	9 340
PLATA (kilogramos)				
México	1 054 829	1 550 221	1 910 839	34 213 850
Perú	1 458 756	1 667 148	1 679 589	19 595 205
PLOMO				
México	157	146	167	5 000
Perú	187	205	230	4 000
RENIO (Toneladas)				
Chile	5	5	4	1 175
Perú	-	-	-	101

PRODUCTO Y PAIS	1981	1982	1983 p/	RESERVAS
RUTILO				
Brasil	N.D.	N.D.	N.D.	90
SAL				
México	7 953	5 561	5 703	N.D.
SELENIO 1/ (Toneladas)				
Chile	15	35	35	21 000
México	12	29	24	3 000
Perú	24	23	20	7 000
TANTALO (Toneladas)				
Brasil	135	77	68	1 300
TELURIO (Toneladas)				
Perú	22	19	18	1 800
TIERRAS RARAS				
Brasil	1	1	1	23
TORIO				
Brasil	N.D.	N.D.	N.D.	75

PRODUCTO Y PAIS	1981	1982	1983 p/	RESERVAS
TUNGSTENO				
Bolivia	3	3	3	4o
Brasil	1	1	1	20
México	-	-	-	17
VANADIO				
Chile	N.D.	N.D.	N.D.	N.D.
Brasil	N.D.	N.D.	N.D.	N.D.
YESO				
México	2 390	2 042	2 958	N.D.
YODO (Toneladas)				
Chile	3	3	2	200
ZINC				
México	212	232	257	8 000
Perú	497	541	575	12 000

p/ Cifras preliminares
1/ Se refiere a productos de recuperación
2/ Se refiere solamente a la producción de cadmio afinado
3/ En contenido de antracita

FUENTE: Mineral Commodity Summaries, Bureau of Mines. Dirección General de Minas, S.E.M.I.P. e investigación directa (para el caso de México)

A N E X O II

P R O D U C C I O N E X P O R T A C I O N I M P O R T A C I O N

M I N E R A E N M E X I C O

1.- PRODUCCION MINERO-METALURGICA EN MEXICO

ANEXO II

PRODUCTO	TONELADAS 1982	TONELADAS 1983 P/	VARIACION % 1983/1982	MILES DE PESOS 1982	MILES DE PESOS 1983 P/	VARIACION % 1982/1983
TOTAL:				132 405 272	302 578 210	128.5
I.- METALICOS (En contenido metálico)				73 965 731	200 231 962	170.7
I.- METALES PRECIOSOS				28 372 493	95 100 306	235.2
Oro (Kgs.)	6 104	6 930	13.5	4 543 387	11 674 555	157.0
Plata (Kgs.)	1 550 221	1 910 839	23.3	23 829 126	83 425 751	250.1
II.- METALES INDUSTRIALES				45 593 238	105 131 656	130.6
Aluminio	41 180	39 706	- 3.6	3 948 585	9 910 662	151.0
Antimonio	1 565	2 819	61.0	181 283	544 494	200.4
Arsénico	3 590	3 452	- 3.8	190 008	397 599	109.3
Bismuto	606	545	-10.1	86 256	189 473	119.7
Cadmio	1 444	1 341	- 7.1	129 195	267 231	106.9
Cobre	239 091	206 062	-13.8	16 098 889	37 158 217	130.8
Estaño 1/	971	1 266	30.4	1 719 663	2 528 269	47.0
Fierro	5 382 239	5 306 343	- 1.4	5 284 141	13 959 075	164.2
Manganeso	183 120	133 004	-27.4	1 402 364	2 318 435	65.3
Mercurio	295	221	-25.1	146 903	248 340	69.1
Molibdeno	5 190	5 866	13.0	4 157 389	6 129 865	47.4
Plomo	145 844	167 405	14.8	3 639 145	7 698 059	111.5
Selenio	29	24	-17.2	10 023	22 998	129.5
Tungsteno	194	186	- 4.1	96 920	181 466	87.2
Zinc	231 910	257 444	11.0	8 502 534	23 577 473	177.3
III.- MINERALES NO METALICOS (Volumen en peso bruto)				58 439 541	102 346 248	75.1
Arcillas Impuras	249 069	213 775	-14.2	153 435	276 485	80.2
Arena y Grava (m^3)	99 413 621	84 004 509	-15.5	22 173 700	27 714 800	25.0
Azufre	1 815 447	1 602 029	-11.8	6 232 338	12 576 606	101.8
Barita	323 753	357 043	10.3	755 197	1 966 053	160.3
Bentonita	184 918	171 140	- 7.5	90 265	316 609	250.8
Calcita	234 694	344 793	46.9	190 150	436 164	129.4
Caliza	40 880 201	35 275 881	-13.7	7 511 737	15 361 028	104.5
Caolín	172 390	162 000	- 6.0	71 542	196 777	175.1
Carbón	7 618 871	8 999 467	18.1	7 505 241	17 719 192	136.1
Celestita	31 676	37 506	18.4	82 990	369 284	345.0
Diatomita	56 342	43 967	-22.0	10 939	28 901	164.2
Dolomita	353 265	285 151	-19.3	21 196	17 109	- 19.3
Feldespato	115 559	117 518	1.7	244 861	494 765	102.1
Fluorita	631 386	556 977	-11.8	3 216 916	6 103 406	89.7
Fosforita	653 050	785 038	20.2	979 575	1 844 839	88.3
Grafito	36 174	44 327	22.5	218 878	574 940	162.7
Magnesita	22 492	23 187	3.1	26 276	49 384	87.9
Mármol	119 759	149 086	24.5	295 661	623 329	110.8
Mica	510	1 560	205.9	1 428	5 109	257.8
Perlita	32 425	41 377	27.6	15 767	32 519	106.2
Sal	5 561 187	5 703 030	2.6	7 762 451	14 035 923	80.8

Producción (Concluye)

PRODUCTO	TONELADAS 1982	TONELADAS 1983 P/	VARIACION % 1983/1982	MILES DE PESOS 1982	MILES DE PESOS 1983 P/	VARIACIC % 1983/19?
Sílice 2/	828 187	929 059	12.2	124 228	139 359	12.?
Talco	12 270	15 092	23.0	3 651	9 961	172.?
Tierras Fuller	42 488	41 574	- 2.2	73 477	145 319	97.8
Vermiculita	522	399	- 23.6	708	997	40.8
Wollastonita	15 599	10 784	- 30.9	9 272	27 615	197.8
Yeso	2 042 484	2 958 085	44.8	667 652	1 279 775	91.7

P/ Cifras preliminares.

1/ Incluye mineral de importación.

2/ Incluye producción de arena para vidrio, cuarzo y silicosos.

FUENTE: Dirección General de Minas, S.E.M.I.P. e investigación directa.

1.- IMPORTACION MINERO-METALURGICA DE MEXICO

ANEXO II

PRODUCTO	1 9 8 2 MILES DE PESOS	1 9 8 3 P/ MILES DE PESOS	% 1983/1982
TOTAL:	21 828 417	39 507 014	81.0
A.- METALICOS	10 304 013	15 579 516	51.2
I.- METALES PRECIOSOS	2 714	7 430	173.8
Platino	2 714	7 430	173.8
II.- METALES INDUSTRIALES	10 301 299	15 572 086	51.2
Aluminio	2 060 086	3 294 867	59.9
Arsénico	170	192	12.9
Berilio	111	-	-
Bismuto	11 215	1 181	- 89.5
Cadmio	100	385	285.0
Cobalto	112 083	165 027	47.2
Cobre	1 442 955	2 164 384	50.0
Cromo	204 715	405 901	98.3
Estaño	651 622	2 001 262	207.1
Fierro	3 629 853	5 253 515	44.7
Magnesio	296 435	588 358	98.5
Manganeso	184 271	15 119	- 91.8
Mercurio	774	-	-
Molibdeno	62 474	10 075	- 83.9
Níquel	1 183 200	836 613	- 29.3
Paladio	9 380	14 402	53.5
Plomo	17 082	4 084	- 76.1
Selenio	7 609	12 451	63.6
Titanio	342 927	723 885	111.1
Tungsteno	67 657	70 159	3.7
Zinc	16 580	10 226	- 38.3
B.- NO METALICOS	11 524 404	23 927 498	107.6
Abrasivos	48 682	57 925	19.0
Alúmina	1 358 410	3 706 442	172.9
Arcillas	658 629	1 336 765	103.0
Arena y Grava	3 916	1 069	- 72.7
Asbesto	1 444 120	3 010 057	108.4
Asfalto	16 293	18 972	16.4
Azufre	30 227	79 972	164.6
Barita	1 090 409	1 522 176	39.6
Bauxita	285 535	587 364	109.2
Bentonita	39 531	16 485	- 58.3
Bórax	3 753	33 296	787.2
Calcita	14 812	36 622	147.2
Caolín	321 345	1 101 725	242.8
Carbón	1 774 330	1 982 965	11.7
Coque	1 322 848	3 124 159	136.2
Criolita	3 159	6 442	103.9
Diatomita	2 780	8 195	194.8

Importación (Concluye)

PRODUCTO	1 9 8 2 MILES DE PESOS	1 9 8 3 P/ MILES DE PESOS	% 1983/1982
Dolomita	9 102	2 030	- 77.7
Feldespato	12 677	12 540	- 1.1
Fluorita	17 785	9 458	- 46.8
Fosforita	1 837 960	4 006 071	118.0
Grafito	23 328	22 149	- 5.1
Magnesita	4 302	682	- 84.1
Mármol	48 213	9 415	- 80.5
Mica	29 636	61 930	109.0
Nefelina Sienita	876	7 046	704.3
Piedra Pómez	1 160	12 540	981.0
Piedras Preciosas o Semipreciosas	7 649	-	-
Pirofilita	543	55	- 89.9
Potasio	573 565	2 031 414	254.2
Sal	5 062	13 311	-162.9
Sílice	225 434	259 411	15.1
Talco	199 273	582 922	192.5
Tierras Fuller	574	2 088	263.8
Vermiculita	9 844	23 887	142.7
Yeso	52 979	54 185	2.3
Zircón	45 663	175 733	284.8

P/ Cifras preliminares.

FUENTE: Instituto Nacional de Estadística, Geografía e Informática, S.P.P. e Instituto Mexicano de Comercio Exterior.

1.- EXPORTACION MINERO-METALURGICA DE MEXICO

ANEXO II

PRODUCTO	1 9 8 2 MILES DE PESOS	1 9 8 3 P/ MILES DE PESOS	% 1983/1982
TOTAL:	46 384 268	133 407 211	187.6
A.- METALICOS	37 259 548	105 023 897	181.9
I.- METALES PRECIOSOS	16 647 100	60 855 920	265.6
Plata	16 647 100	60 855 920	265.6
II.- METALES INDUSTRIALES	20 612 448	44 167 977	114.3
Aluminio	28 810	76 031	163.9
Antimonio	39 202	106 087	170.6
Arsénico	198 076	439 000	121.6
Bismuto	81 457	207 059	154.2
Cadmio	34 273	42 679	24.5
Cobre	11 544 238	20 323 029	76.0
Fierro	448 619	1 553 650	249.4
Manganeso	570 129	1 202 301	110.9
Mercurio	90 702	264 189	191.3
Molibdeno	1 434 562	4 107 076	186.3
Níquel	144	279	93.8
Plomo	2 371 959	3 746 912	58.0
Selenio	1 644	9 424	473.2
Tungsteno	98 596	135 535	37.5
Zinc	3 674 037	11 954 726	225.4
B.- NO METALICOS	9 124 720	28 383 314	211.1
Abrasivos Naturales	21	-	-
Alúmina	1 882	4 132	119.6
Arcillas Impuras	1 632	2 961	81.4
Arena y Grava	1 159	16 582	-
Asbesto	1	-	-
Asfalto	94 599	616 323	551.5
Azufre	3 641 675	12 890 651	254.0
Barita	202 429	408 182	101.6
Bentonita	1 327	3 770	184.1
Caliza	268	2 286	753.0
Caolín	304	13 592	-
Carbón	44 600	144 939	225.0
Celestita	68 542	446 657	551.7
Coque	-	2 821	-
Diatomita	30 409	103 650	240.9
Dolomita	1 910	2 625	37.4
Feldespato	39	-	-
Fluorita	1 656 619	3 844 845	132.1
Fosforita	58 614	81 871	39.7
Grafito	183 436	279 200	52.2
Mármol	12 356	63 215	411.6
Perlita	20 687	119 295	476.7

Exportación (Concluye)

PRODUCTO	1 9 8 2 MILES DE PESOS	1 9 8 3 P/ MILES DE PESOS	% 1983/1982
Piedra Pómez	-	771	-
Piedras Preciosas o Semipreciosas	227 787	62 449	- 72.6
Sal	2 242 332	5 232 261	133.3
Sílice	169 394	398 959	135.5
Tezontle	439	147	- 66.5
Tierras Fuller	241 187	12 247	- 94.9
Vermiculita	132	-	-
Wollastonita	567	4 039	612.3
Yeso	220 373	3 624 844	-

P/ Cifras preliminares.

FUENTE: Instituto Nacional de Estadística, Geografía e Informática, S.P.P., Instituto Mexicano de Comercio Exterior e investigación directa.

A N E X O III

CONSUMO DE LOS PRINCIPALES PRODUCTOS MINERO-METALURGICOS

EN MEXICO

ANEXO III

M E X I C O

CONSUMO DE LOS PRINCIPALES PRODUCTOS MINERO-METALURGICOS

TONELADAS

1 9 8 3

CONCEPTO	PRODUCCION	IMPORTACION	EXPORTACION	CONSUMO NACIONAL APARENTE
I. METALICOS 1/				
Cobre	206 052	-	-	70 171
Fierro	5 306 343	-	-	5 305 161
Plata (Kgs.)	1 910 839	-	1 386 307	524 532
Plomo	167 405	-	-	85 793
Zinc	257 444	-	-	88 817
II. NO METALICOS 2/				
Arcillas	213 775	94 706	79	308 402
Azufre	12 576 606	500	997 322	11 579 784
Barita	757 043	90 538	126 208	721 373
Bentonita	171 140	481	570	171 051
Caolín	162 000	60 430	234	222 196
Carbón	8 999 467	278 810	1 403	9 276 874
Coque	2 996 126	94 997	91	3 091 032
Fluorita	556 977	-	436 709	120 268
Fosforita	785 038	1 115 846	21 846	1 878 192
Sal	5 703 030	448	3 942 108	1 761 370

1/ Se refiere al consumo real.

2/ Peso bruto.

FUENTE: Anuario Estadístico de la Minería Mexicana, C.N.M., Grupo de Estudio del Cobre, A.C., Cámara Nacional de la Industria del Hierro y del Acero, e Instituto Mexicano del Zinc, Plomo y Coproductos, A.C.

CONSUMO NACIONAL DE FIERRO EN LA INDUSTRIA SIDERURGICA

Toneladas

AÑOS	MINERAL DE HIERRO 1/
1979	6 169 000
1980	5 467 797
1981	5 744 000
1982	5 383 315
1983	5 305 161

1/ Se refiere a contenido metálico. Se estima que la ley del mineral es del 55%.

FUENTE: Cámara Nacional de la Industria del Hierro y del Acero.

ANEXO III

PRODUCCION Y CONSUMO DE COBRE ELECTROLITICO
EN MEXICO

(TONELADAS)

AÑO	PRODUCCION BLISTER	PRODUCCION ELECTROLITICO	CONSUMO
1979	88 053	100 853	100 927
1980	87 857	102 742	117 051
1981	65 348	70 767	131 030
1982	63 761	77 700	87 551
1983	59 357	80 241	79 171

FUENTE: Grupo de Estudio de Cobre, A.C.

A N E X O IV

E M P R E S A S M I N E R A S M E X I C A N A S

I N T E G R A D A S V E R T I C A L M E N T E

MET - MEX PEÑOLES, S.A. DE C.V.

PLANTA ELECTROLITICA DE ZINC:

UBICACION: TORREON, COAH.
FECHA DE TITULACION: 19-MAYO-1970
INICIO DE OPERACIONES: AÑO DE 1973 INVERSION: 60 MILLONES DE PESOS
CAPACIDAD: 288 T.M.D. DE ZINC AFINADO

FUNDICION DE PLOMO/PLATA:

UBICACION: TORREON, COAH.
INICIO DE OPERACIONES: AÑO DE 1901 APROX.
CAPACIDAD:
FECHA DE TITULACION: 3-SEPTIEMBRE-1969
CAPACIDAD: 1,060 T.M.D. DE CARGA.

REFINERIA DE PLOMO/PLATA:

UBICACION: MONTERREY, N.L.
INICIO DE OPERACIONES: 1880 (EMPRESA BENEFICIADORA DE MINERALES, Y METALES,S.A.)
1901 (METALURGICA MEXICANA PEÑOLES, S.A.)
CAPACIDAD:
FECHA DE TITULACION: 3-SEPTIEMBRE-1969
CAPACIDAD: 450 T.M.D. DE BULLION

POSTERIORMENTE TRANSLADADA A:

UBICACION: TORREON, COAH.
FECHA DE TITULACION: 13 - OCTUBRE - 1976
CAPACIDAD: 493 T.M.D. DE BULLION
INICIO DE OPERACIONES: AÑO DE 1976

INDUSTRIAL MINERA MEXICO, S.A.

FUNDICION DE PLOMO:

UBICACION: CHIHUAHUA, CHIH.
INICIO DE OPERACIONES: AÑO de 1910 APROX.
CAPACIDAD: 5 HORNOS - 274 000 TONS. ANUALES
FECHA DE TITULACION: 28- FEBRERO-1968
CAPACIDAD: 1400 T.M.D. DE CARGA.

REFINERIA DE PLOMO:

UBICACION: MONTERREY, N.L.
INICIO DE OPERACIONES: AÑO DE 1910 APROX.
CAPACIDAD: 10 HORNOS - 475 TONS. ANUALES
FECHA DE TITULACION: 26-AGOSTO-1968
CAPACIDAD: 520 T.M.D. DE BULLION

FUNDICION DE COBRE:

UBICACION: SAN LUIS POTOSI, S.L.P.
INICIO DE OPERACIONES: AÑO DE 1911 APROX.
CAPACIDAD:
FECHA DE TITULACION: 8-OCTUBRE-1968
CAPACIDAD: 670 T.M.D. DE CARGA

PLANTA ELECTROLITICA DE ZINC:

UBICACION: SAN LUIS POTOSI, S.L.P.
FECHA DE TITULACION: 28-JUNIO-1979
CAPACIDAD: 603 T.M.S. DE CARGA
INICIO DE OPERACIONES: AÑO DE 1982

CIA. MINERA DE CANANEA, S.A. DE C.V.

Ubicación: Cananea, Son.
Tipo de Mineral: Cobre Blister
Fecha de Inicio de Operaciones: 1901
Capacidad de Producción Inicial: 45,000 T/A
Capacidad de Producción Actual : 45,000 T/A
Sistema de Beneficio: Fundición

Ubicación: Cananea, Son.
Tipo de Mineral: Oro
Fecha de Inicio de Operaciones: 1899
Capacidad de Producción Inicial:
Capacidad de Producción Actual :
Sistema de Beneficio: Fundición

CIA. MINERAL DE REAL DEL MONTE Y PACHUCA, S.A. DE C.V.

Ubicación: Pachuca, Hgo.
Tipo de Mineral: Plata
Fecha de Inicio de Operaciones: 1906
Capacidad de Producción Inicial:
Capacidad de Producción Actual :
Sistema de Beneficio: Afinación

Ubicación: Pachuca, Hgo.
Tipo de Mineral: Oro
Fecha de Inicio de Operaciones: 1947
Capacidad de Producción Inicial:
Capacidad de Producción Actual :
Sistema de Beneficio: Afinación

ALTOS HORNOS DE MEXICO, S.A.

Ubicación:
Tipo de Mineral: Arrabio
Fecha de Inicio de Operaciones: 1944
Primer Alto Horno
Capacidad de Producción Inicial: 200 T/D
Capacidad de Producción Actual :6,400T/D

Ubicación:
Tipo de Mineral: Acero
Fecha de Inicio de Operaciones: 1944
Primer Alto Horno
Capacidad de Producción Inicial: 65,000 T/A
Capacidad de Producción Actual : 3.2 millones de T/A

MINERA CAPELA, S.A. DE C.V.

Ubicación: Coalcomán, Mich.
Tipo de Mineral: Barita
Fecha de Inicio de Operaciones: 1983
Capacidad de Producción Inicial: 20,000 T/M
Capacidad de Producción Actual : 20,000 T/M
Sistema de Beneficio: Concentración por flotación

BARAMIN, S.A. DE C.V.

Ubicación: Galeana, N.L.
Tipo de Mineral: Barita
Fecha de Inicio de Operaciones: 1953
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 200
Sistema de Beneficio: Concentración gravimétrica

Ubicación: El Dorado, Chih.
Tipo de Mineral: Barita
Fecha de Inicio de Operaciones: 1953
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 75
Sistema de Beneficio: Concentración gravimétrica

Ubicación: General Cos, Coah.
Tipo de MIneral: Barita
Fecha de Inicio de Operaciones: 1953
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 75
Sistema de Beneficio: Concentración gravimétrica

NEG. MINERA EULALIO GUTIERREZ, S.A.

Ubicación: Saltillo, Coah.
Tipo de Mineral: Barita
Fecha de Inicio de Operaciones: 1967
Capacidad de Producción Inicial: 250
Capacidad de Producción Actual : 350
Sistema de Beneficio: Concentración por flotación

CIA. MINERA DE SANTA ROSALIA, S.A.

Ubicación: Santa Rosalía, B.C.S.
Tipo de Mineral: Cobre
Fecha de Inicio de Operaciones: 1954
Capacidad de Producción Inicial: 5,000 T/A
Capacidad de Producción Actual : 900 T/A
Sistema de Beneficio: Fundición

CIA. MINERA AUTLAN, S.A. DE C.V.

Mina Tetzintla
Ubicación: Molango, Hgo.
Tipo de Mineral: Carbonato de Manganeso
Fecha de Inicio de Operaciones: 1974
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 396,000 T/A
Sistema de Beneficio:

Planta Ayotetla
Ubicación: Molango, Hgo.
Tipo de Mineral: Nódulos de Manganeso
Fecha de Inicio de Operaciones:
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 69,120 T/A
Sistema de Beneficio:

Planta de Nonoalco
Ubicación: Nonoalco, Xochicoatlán, Hgo.
Tipo de Mineral: Manganeso
Fecha de Inicio de Operaciones: 1964
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 68,400 T/A
Sistema de Beneficio: Concentración Mecánica

Planta de Tamós
Ubicación: Tamós, Veracruz
Tipo de Mineral: Ferromanganeso y Ferrosilício
Fecha de Inicio de Operaciones: 1976
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 54,720 T/A
Sistema de Beneficio: Fundición

Planta Teziutlán
Ubicación: Teziutlán, Puebla
Tipo de Mineral: Ferromanganeso y Ferrosilício
Fecha de Inicio de Operaciones:
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 63,000 T/A
Sistema de Beneficio: Fundición

GRUPO VITRO

Materias Primas Monterrey, S.A.
Ubicación: Jaltipan, Ver.
Diversidad de Vidrio
Fecha de Inicio de Operaciones: 1955
Capacidad de Producción Inicial: 1,250 T/M
Capacidad de Producción Actual : 1,300 T/M
Sistema de Beneficio: Lavado, clasificado, atrición y flotación

GRUPO VITRO

Materias Primas Minerales de Lampazos, S.A.
Ubicación: Lampazos de Naranjo, N.L.
Diversidad de Vidrio
Fecha de Inicio de Operaciones: 1974
Capacidad de Producción Inicial: 10,000 T/M
Capacidad de Producción Actual : 25,000 T/M
Sistema de Beneficio: Lavado, clasificado, atrición, flotación y lixiviación

Materias Primas Minerales San José, S.A.
Ubicación: San José de Iturbide, Gto.
Diversidad de Vidrio
Fecha de Inicio de Operaciones: 1963
Capacidad de Producción Inicial: 7,000 T/M
Capacidad de Producción Actual : 8,250 T/M
Sistema de Beneficio: Lavado, clasificado, atrición y flotación

Materias Minerales de Ahuazotepec, S.A.
Ubicación: Ahuazotepec, Pue.
Diversidad de Vidrio
Fecha de Inicio de Operaciones: 1958
Capacidad de Producción Inicial: 1,000 T/M
Capacidad de Producción Actual : 7,000 T/M
Sistema de Beneficio: Lavado, clasificado, atrición y flotación

BARITA DE SANTA ROSA, S.A. DE C.V.

Ubicación: Melchor Múzquiz, Coah.
Tipo de Mineral: Barita
Fecha de Inicio de Operaciones:
Capacidad de Producción Inicial:
Capacidad de Producción Actual : 300
Sistema de Beneficio: Concentración gravimétrica

BARITA DE SONORA, S.A.

Ubicación: Mazatán, Son.
Tipo de Mineral: Barita
Fecha de Inicio de Operaciones: 1983
Capacidad de Producción Inicial: 600
Capacidad de Producción Actual : 750
Sistema de Beneficio: Molienda en seco

COBRE DE MEXICO

Ubicación: México, D.F.
Tipo de Mineral: Cobre
Fecha de Inicio de Operaciones: 1943
Capacidad de Producción Inicial: 72,000 T/A
Capacidad de Producción Actual :120,000 T/A
Sistema de Beneficio:

MEXICANA DE COBRE

Capacidad de Producción Actual: 180,000 T/A
Sistema de Beneficio: Fundición

CIA. FUNDIDORA DE MONTERREY, S.A.

Tipo de Mineral: Arrabio
Fecha de Inicio de Operaciones: 1903
Capacidad de Producción Inicial: 300 T/D
Capacidad de Producción Actual :3,000 T/D

Tipo de Mineral: Acero
Fecha de Inicio de Operaciones: 1903
Capacidad de Producción Inicial: 100,000 T/A
Capacidad de Producción Actual :1'350,000 T/A

CIAS. FILIALES DE FUNDIDORA DE MONTERREY, S.A.

Carbón y Minerales Coahuila, S. A.
Ubicación: Las Esperanzas, Mpio. de Melchor Múzquiz, Coah.
Tipo de Mineral: Carbón "Todo-Uno"

Carbón y Cok, S. A.
Ubicación: Las Esperanzas, Mpio. de Melchor Múzquiz, Coah.
Tipo de Mineral: Carbón "Todo-Uno"

Hullera Saltillito, S. A.
Ubicación: Las Esperanzas, Mpio. de Melchor Múzquiz, Coah.
Tipo de Mineral: Carbón "Todo-Uno"

CIAS. FILIALES DE FUNDIDORA DE MONTERREY, S.A.

Hullera Mexicana, S. A.
Ubicación: Las Esperanzas, Mpio. de Melchor Múzquiz, Coah.
Tipo de Mineral: Carbón "Todo-Uno"
Capacidad de Producción Actual: 7,000 T/D
Sistema de Beneficio: Lavado

Hullera Mexicana, S. A.
Ubicación: Las Esperanzas, Mpio. de Melchor Múzquiz, Coah.
Tipo de Mineral: Carbón "Todo-Uno", Carbón Lavado y Coque
Capacidad de Producción Actual: 2,500 T/D
Sistema de Beneficio: Coquizado